A STUDY OF CENTRAL CORNEAL THICKNESS AND CORNEAL CURVATURE IN PRIMARY ANGLE CLOSURE GLAUCOMA

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DEDICATED
TO
HUMANITY

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CERTIFICATE

This is to certify that the work entitled "A STUDY OF CENTRAL CORNEAL THICKNESS AND CORNEAL CURVATURE IN PRIMARY ANGLE CLOSURE GLAUCOMA" has been carried out by Chitra Singh in this department. It is further certified that the candidate has fulfilled the condition of residency as under the rule.

He has also fulfilled all the conditions necessary for the submission of this thesis.

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INTRODUCTION

A STUDY OF CENTRAL CORNEAL THICKNESS AND CORNEAL CURVATURE IN PRIMARY ANGLE CLOSURE GLAUCOMA.

INTRODUCTION

Primary angle closure glaucoma (PACG) is an important blinding disease causing temporary and permanent visual loss all over the world. It occurs in eyes with a recognizable predisposition. One of the important factor is shallow chamber with narrow angle.

The size and shape of the anterior chamber results directly from the structure bordering it. These structures are basically the lens and the cornea. Three parameters of the lens affects its role in determining the depth of the anterior chamber; its thickness. the intraocular position and its growth with age. Two aspects of the cornea may affect anterior chamber depth! the corneal thickness and the radius of curvature. The eyes with primary angle closure glaucoma have thicker cornea and lesser radius of curvature.

The above corneal parameters of the eye, thus play a significant role in the genesis of PACG. They have been evaluated by various methods in the past. Computerized ultrasonic Pachymeter provides accurate and reliable data regarding these parameters.

Significant studies highlighting the role of these biometrical parameters in the genesis of PACG. in Indian subjects, have not been done in the past. It is with this aim that this study, has been undertaken.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

[1] AETIOLOGY OF PRIMARY ANGLE CLOSURE GLAUCOMA

Following the observation of Raeder (1923) and Rosengren (1930) that patients with acute glaucoma had shallow anterior Chamber, Barkan (1936-54) demonstrated that primary angle closure glaucoma occurred in an eye with a goniscopically narrow filteration angle. His observations have been confirmed by Gradle and Sugar (1940) , Sugar (1941), Kronfeld and McGarry (1944) francois (1948), Chandler (1952), Miller (1952) and smith (1954).

The causes of narrow filterration angle are several :

[A] ANATOMICAL FACTORS :

[a] Disproportion between the size of the lens and size of the anterior segment of the eye :

The presence of a relatively large lens in a small eye is the most important cause. This idea was first suggested by Bowmen (1852) and was elaborated by Priestley Smith (1879). There is no doubt that the lens increases in size almost throughout life. (Smith 1883, Raeder 1922, Scammon and Hersdoffer 1937) and that the depth of the anterior chamber decreases (Raeder 1922, Rosengren 1930, Tornquist 1953) partly as a result of the growth of the lens and to a smaller extent because of the slight advance of the lens towards the cornea attributable to morphological changes in the Ciliary muscle (Weale 1962).

[b] **Nan Ophthalmos** :

It represents a special conditon of high hyperopia in which there is an abnormal small eyeball containing a crystalline lens of disproportionately normal size. The sclera may be more than twice as thick as normal and there is a strong tendency to uveal effusion which detaches choroid and the retina after operation (Brockhurst 1974-75).

[c] **Plateau Iris** :

In small proportion of eyes subject to angle closure glaucoma the axial depth of the anterior chamber is not noticeably shallow and the iris from the pupil nearly to periphery is not noticeably convex yet in far periphery, there is a convexity of the iris that narrows and may close the angle, sometimes called Plateau Iris. (Tornquist 1958, Lowe 1964, Chandler and Grant 1965). In these eyes the iris is inserted into the Ciliary body further forwards than is usual, with the result that the entrance of the angle is narrow. When the pupil is dilated the periphery of the iris bunched up and presses itself against the trabeculae, closing the angle. This can lead to a rare complication of recurrence of glaucoma after iridectomy (wand et al 1977)

[B] **PREDISPOSING FACTORS** :

[a] **Pupillary Blocks** :

The concept of pupillary blockage in the precipitation of attacks of primary angle closure glaucoma was first proposed by Curran (1920-31). Barkan (1938-54) suggested that it was a major aetiological factor, caused by a disproportionately large lens or by an anterior displacement of this structure. It leads to a narrowing of the filteration angle which is already narrow and it may close by irido-corneal contact thus producing an attack of raised tension (Chandler 1952,Chandler and Trotter 1955, Sugar 1964, Chandler and Grant 1965, Becker and Shaffer 1965, Lowe 1966

Pollack 1967). It is generally assumed that in an eye with a relatively large lens and a shallow anterior chamber a greater area of the iris comes in contact with the lens than is usual (Chadler 1952,Barkan 1954) and that the sphincter muscle exerts a posteriorly directed vector of force pressing it against the lens (Sugar 1964). Mapstone (1968) stressed theimportance of stretching of iris by the contraction of the dilator iridis. Mapstone (1974) believed that the pupillary blocking force of the sphinctor is greatest when the pupil is about 3.5 to 4 mm in diameter.

[b] **Mydriasis** :

A rise of ocular tension may follow the use of mydriatics. This has been attributed in some cases to crowding of the angle of the anterior chamber with the retracted iris (Barkan 1968, Lowe 1964-66, Pollack 1967). Lowe (1966) demonstrated that para sympatholytic drugs tend to cause closure of the angle by bunching the peripherel iris into it, while sympathomimetic drugs increase the tendency of pupillary blockage.

[c] **Miosis** :

The stronger miotics (anticholinesterase drugs.) are liable to precipitate attacks of acute angle closure glaucoma in patients with narrow filteration angles (Stone 1950, Butler 1952, Zeckman and Syndecker 1953, Becket et al 1959, Drance 1960, Krishna and Leopald 1960). They cause pupillary blockage in susceptable eyes (Becker and Shaffer 1965,Chandler and Grant 1965, Drance 1960, Shaffer 1967).

[d] **Accomodation** :

Acute rise of intra ocular pressure may occur due to accomodation while reading (Miller 1953, Higgitt and Smith 1955). Higgit and Smith (1955) suggested that rise of ocular tension was due to rotation of the ciliary body about the scleral spur resulting in angle closure.

[e] Vasomotor Instability :

Earlier it was believed that disorganization of capillary function precipitated an acute attack by liberation of histmaine like substances (Friedenwald 1930, Duke-Elder 1931). Later it was suggested that congestion of ciliary body included vasomotor disturbances and consequently secondary closure of the filteration angle (Duke-Elder 1949-57, Weinstein 1960). On the other hand it has been argued that such vascular congestion was the result of an acute attack of raised tension rather than its cause (Chandler 1952, Barkan 1954, Chandler and Grant 1965).

"Psychic Disturbances" : They have been frequently said to determine the onset of an acute attack (Gartner and Billet 1958, Croll 1960). The emotional and excitable temperament has been recognised by Posner and Schlossman (1948).

"Swelling of Vitreous" : Barkan (1954) suggested that one of the, factor producing an increasingly shallow anterior chamber was expression of vitreous compartment. The lens appeared to be displaced forwards by pressure from vitreous [Christensen and Irvine 1966].

"Refractive Condition" : There is little doubt that a hypermetropic refractive error is particularly common in primary closed angle glaucoma [Fuchs 1924, Sugar 1941-57, Barkan 1954, Becker and Shaffer 1965]. It has been demonstrated that hypermetropia tends to be associated with a shallow anterior chamber than normal (Rosengren 1930-50, Sugar 1942) and that high degrees of hypermetropia tend to be associated with a reduced axial length of the eye and flattening of the cornea [Stenstorm 1946, Phillips1956]. The central anterior chamber depth is related to degree of ametropia of the eye [Lindstedt. 1916, Raeder 1922].In Myopia, particularly high myopia, the refractive error is less pronounced as compared with hyperopia [Lindstedt 1916].

[2] MEASUREMENTS

[I] ANTERIOR CHAMBER :

Numerous methods have been devised for measuring the depth of the anterior chamber.Von Helmholtz (1856) first made accurate measurement adapting his ophthalmometer for this purpose Tscherning's (1898) methodof ophthalmophakometery is also applicable for estimation of anterior chamber depth. Donders (1872) on the other hand employed a corneal microscope with which the anterior surface of cornea and then the edge of the pupil were focussed. The method can be used clinically with the slit lamp by means of Ulbrich's (1914) drum mounted upon the microscope.

Several other special techniques have been employed. The principle of Von Helmholtz's instrument has been modified by inserting one or two rotatable glass plates into the beam of the slit lamp as in the instrument of Von Bahr (1948), Maurice and Giardini (1951) and Jaeger (1952). By the use of totally refracting prisms, Raeder (1922) simutaneously focussed the pupillary margin in one ocular of the corneal microscope and the corneal surface on the other, the adjustments of the ocular required to do this allowed a calculation of depth of the anterior chamber. By using a spherocylindrical optical system Lindstedt (1916), Rosengren (1930-31) and Stenstorm (1953) could focus the anterior focal line on the proximal surface and the posterior on the more distant surface, the interfocal distance giving the depth of the anterior chamber (Tornquist 1953, Syndeker 1956)

A further method which avoids error due to movements of the subject make use of the photography of an optical section of the eye as seen by the slit lamp (Hein 1941, Goldmann 1941, Bleeker 1960-61).

Studies of Anterior Chamber Depth

Investigator	Method	No.of Subject	Age (Yr.)	Ant. Cham. depth	Relation of Ant. To Age	Cham. depth. To Ametropia	To Sex
Lindested 1916	Illuminator with two simultaneous spheroeglindrical focal lines	254	<15-80	Emmetropes 31-50 Yr. 3.6 mm	[Diminishes 0.013 mm/Yr after age 15]	Myopes have deepar chamber, hyperopes have shallower chamber	
Raeder 1922	Optical beam splitter	60	<28-88	Emmetropes, 40-59yr, 3.1mm	[Depth diminishes 0.113 mm/yr after age 20	Same findings as Lindestdt	
Rosengren 1938	Lindestdt's appratus	208	25-92	Emmetropes 40 yr male & Female subjects, 3.4 mm	[Depth diminishes 0.014 mm/yr]	[Depth is 0.03mm/ diepter greater in myopia, less in hyperopia]	Male dim-ension 9% larger than female
Heim 1941	Slit lamp photogrammetry	102	9-68	Emmetropes 40yr 3.4mm	[Depth diminishes 0.019 mm/yr after age 20]	[Depth is 0.04 mm/	D greater in myopia less in hyperopia]
Stenstprm 1948	modification of Lindesdt's method						Male dime nsion 1% larger than female
Calmettes et al 1958	Jaeger's beam spillter on slit lamp	205	4-85	Emmetropes 30-50 yr, male & female subjects, 3.5 mm	[Depth diminishes 0.014 mm/yr after age 28]	Depth is 0.17 mm less per D in hyperopia; depth unchanged in myopia	Male dime nsion 6% larger than female
Weekera et al 1961	Goldman slit - lamp pachymeter	147	<15->55	Emmetropes, 35-55 yr, 3.3 mm	Depth diminishes 0.010 mm/yr	. .....	. .....
Weeker & Grieten 1961	Goldmann's pachymeter	287	<35->35	Emmetropes >35 yr 3.2 mm	.....	<35yr.depth is 0.035 mm/D less in hyperopia; >35yr regression is 0.050 mm/D	...
Weekers et al 1967	Ultrasonog-graphy & goldmann's pachymeter	380	1-85	Emmetropes, 25-50yr. 2.9 mm	Depth diminishes 0.008 mm/yr	Myopes have deeper chambers; hyperopes have shallower chambers	

Investigator	Method	No.of Subject	Age (Yr.)	Ant. Cham. depth	Relation of Ant. To Age	Cham. depth. To Ametropia	To Sex
Larsen 1971	Ultrasono-graphy.	846	0-13	Male sub. 10 yr, 3.2mm female sub. 8 yr.3.1mm	Depth increases 0.10/ yr, then stable 10 to 13 yr	Depth is 0.12 mm/D greater myopes,less in hyperopes among 12yr girls.	Male dimension, 2% larger than female
Fontana & Brubaker 1979	Slit-lamp photograph special scale overlay	312	11-80 mean 40	Male sub. 3.0 mm female sub 2.9mm (age40 emmetropia)	Depth diminishes 0.01 mm/yr	Depth is 0.06 mm/D deeper in myopia shallomer in hyperopia.	Male dimension 4% greater than female

Latest methods have been employed to measure the depth of the anterior chamber. Markowitz (1984) used A-scan Ultrasonography, Makabe (1989) used B-scan Ultrasonography. Lee et al (1984) Photo grammetrically estimated the depth of anterior chamber.

The true depth of the anterior chamber is usually about 3 mm in an adult emmetrope but this is one of the parameters in optical measurements which is subject to considerable variation. From various observations it was obvious that upto 48 years, average anterior depth is between 2.5 to 3 mm while average anterior chamber depth above 48 years was 2.1 to 2.5 mm. It was striking that in patients above 70 years as many as 40% had anterior chamber depth less than 2 mm. Indian probably have a shallower anterior chamber than the white caucasian eyes

[II] AXIAL LENGTH:

The method of measurement of axial length of the globe may be either indirect or direct.

[A] Indirect or optical Method :

This method makes use of the technique of opthalmophakometry. A further method of deducing the axial length of the eye depends on chromatic aberration. Schoute (1940) and Colenbrander (1940) pointed out that the position of circles of diffusion in the fovea depends on the axial length of the eye, a measure which is proportional to the difference in the apparent distance between objects of different colours. By the use of monochromatic red and blue light it is possible to measure exactly the chromatic aberration of the eye and deduce therefrom reliable values for this defect of the lens, moreover assuming that the specific chromatic aberration in all human eyes is identical, the refractive power of the lens and the axial length of the eye can be deduced therefrom.

[B] **Direct Method** :

These methods make use of non optical techniques and the two most widely used are by means of X rays and ultrasonic vibrations.

[1] **X-Rays** :

The first to measure the axial length of the eye by X rays was Rushton (1938). His technique depends on the sensitivitily of dark adapted eyes to these radiations, a fact known to the pioneers of radiology (Edison 1898, Rontgen 1897, Dorn 1898) but almost forgotten until it was rediscovered by Pirie (1932) and used clinically by Gifford and Bath (1934) to test retinal function in eye with opaque media and for the subjective localization of intraocular foreign bodies.

Rushton's apparatus has been modified by Goldmann and Hagen(1942) and Sorsby and O' Connor (1945) and has been most extensively used by Stenstorm with its aid it has been conclusively demonstrated that the axial length varies independently of the total refraction of the eye. Although a subjective method unsuitable for young subjects, it is generally considered to be reasonably reliable and is often used as a standard for the accuracy of other methods of measurement (Sorsby et al 1957, Jansson 1963)

[2] **Ultrosonography** :

This technique pioneered by Mundt and Hughes (1956) has extensively investigated by Oksala and Lehtinen (1957-61), Oksala (1958-65), Jansson (1963), Sorsby et al (1963), Gernet (1965), Francesscheti and Gernet (1965) Weekers et al (1967) and Coleman and Carlin (1967). It is of accepted value in the measurement of intraocular distances, particularly the axial length of the eye. The technique used is the

time amplitude recording of the echoes received from various ocular interfaces. The time taken for ultrasonic energy to travel from a transducer through the eye to the reflecting interface and back again to a transducer is measured. The determination of intra ocular distance depends on the speed of the ultrasonic vibrations in the various media of the eye. The following velocities of ultrasound in the various media at 22 degree C was given by Oksala and Lehtinen (1958).Cornea 1550 mts/sec,mts/see.,aqueous and vitreous 1495, lens 1650 Sclera 1630 the speed is some greater than in the aqueous and vitreous.

THE AXIAL LENGTH OF THE EYE

Indirect Method	Gullstrand (1924)	24.0 mm	
Radiographic Method	Goldmann and Hagen (1942) Stenstorm (1946)	23.4 mm 23.92 mm	
Ultrasonic Method	Yamamote et al (1961) Franken (1961) Jansson (1963) Males Females	23.1 mm 25.0 mm 24.0 mm 23.14 mm	
Opto-Ultrasonic Method	Bernet (1963-64) Males Females	23.3 mm 22.7 mm	(0.7,-0.7) (0.9,-0.9)

Comparison between the results of ultrasonic measurements show good agreement with those obtained by other methods, such as phakometry and by X-rays (Sorsby et al 1963). It is a simpler technique than the optical methods and being objective can be used in young children. Alternatively, a combination of the optical and ultrasonographic

measurement was employed by Gernet (1963). However the ultrasornic method has been formidably criticised by Baum and Greewood (1961) and Baum (1967).

The average value of axial length in emmetropic eye is between 23 mm and 24 mm, while the eye is somewhat shorter than that of males, indicating a higher refractive power in female emmetropes.

[III] CORNEAL THICKNESS:

The precise measurement of the corneal thickness is not easy due to the faintness of the second purkinje image.Petit (1723) was the first to perform scientific measurement of corneal thickness.Instrumentation for the measurement of corneal thickness by optical means was apparently first accomplished by Blix (1880). The method used involved the observation of the specular reflection from the epithelial and endothelial surfaces of the cornea.

Gullstrand (1924) was the next to measure the cornea and although his method was accurate it involved the use of complicated equipments and evidently was more time consuming. Reflections from the corneal surfaces were used to take measurements. Martinger (1921) was the first to use the slit lamp beam for-measuring corneal thickness. A similar method was used by Juillerat and Koby (1928) who also used a slit lamp beam. Goldmann (1932) was apparently the first to use a split ocular to measure the optical section of the slit lamp beam. '

A modern method for measurement of the corneal thickness was first introduced by Von Bahr (1948). Measurement was done on a modification of the principle used by Blix, Maurice and Giardini used the principle of the Von Bahr apparatus. A somewhat similar instrument was devised by Mishima and Hedbys (1968) Donaldson (1968) made an image spilitting eye piece for measurements. Maratola and Baum (1968) estimated the

central and peripheral corneal thickness. Kremer et al (1985) and Arne et al (1986) used ultrasonic pachometer to measure corneal thickness.

There have been several studies concerning central corneal thickness. Maurice and Giardini(1951) and Maratola and Baum(1968) estimated peripheral corneal thickness. The axial thickness of the cornea is approximately half millimeters. The central corneal thickness doesn't vary significantly but the peripheral thickness has a tendency to decrease in older age groups. Consequently the ratio of peripheral to central thickness decreases with age and after 58 years age this decrease is statistically significant.

[IV] CORNEAL CURVATURE:

In the measurements of the optical constants of the eye extensive use was made of the Catoptic images formed by reflection at the interface, these act as spherical mirrors and such provide a means of measuring the curvature of the reflecting surfaces.

These catoptic images formed by the optical surfaces were first described by Johnsens E, Purklnje (1823) and rediscribed by Louis J Sanson (1838) who first used them for diagnostic purposes. It may be of interest to note that images of Purkinje are of first order since they are formed by a single reflection at an ocular surface while others are of the second order as they are formed by multi reflections. The optical constants of the eye cannot be measured directly in the living eye, consequently an indirect optical method is used.

The first measurement of the curvature of the anterior surface of the cornea was made by Christopher Scheiner (1619).Krause (1832) attempted measurement of corneal radius in excised eye. Kohlausch (1840) tried to determine the corneal radius of curvature by measuring the reflected images formed by cornea of an object of known size at a known distance from cornea. The more accurate technique of

Keratometry makes use of the first Parkinje image Von Heimbltz (1856). Landolt (1877) and Javal and Schiotz (1881) made several modifications. Weistheimer (1965) introduced an ingenious photo-electric Keratometer where in a series of photoelectric cells received the light reflected from the cornea as a beam formed by a narrow slit moved across its surface.

Recent innovations in instrument designs have lead to the development of auto-keratometer which is computer based. The auto-keratometer measures 5-7 mm of central corneal zone and at the same time gives information of the central contour and curvature in its adjacent periphery.

The typical value for the radius of curvature of the anterior surface of the cornea is 7.70 mm and for the posterior surface 6.7 mm (Gullstrand 1911).

[3] CORRELATION

[A] ANTERIOR CHAMBER:

Acute congestive glaucoma occurs in eyes with a recognizableanatomical predisposition is known for many yearsGraefe (1857). Priestiey Smith (1891) concluded that the shallow anterior chamber eccured already before the disease and was an expression of disproportion between the size of the eyeball and lens,and was an important etiological consideration for glaucoma . (Rosengren 1930, 1931, 195O) presented convincing statistical evidence regarding shallowness of the anterior chamber as an important factor. Gonioscopy showed that a narrow angle of the anterior chamber accompanies a shallow (Barkan 1938) Sugar (1941). It is well recognised, however that a small but appreciable percentage of cases of goniscopically proven primary closed angle glaucoma has a normal chamber (Barkan 1954), many of these cases being excample of "plateau iris" (Shaffer 1956, Chandler 1956, Tornquist 1958, Becker and Shaffer 1965,Groin and Posner 1967). Weekers and Grieten (1961),Tomlinson and

Leighton (1973, 1974) and Lowe & Clark (1973) suggested that anterior chamber dimensions might be abnormal in certain inherited disorders, such as primary angle closure glaucoma. Tornquist (1953) considered that one specific dominant gene was responsible for the shallow anterior chamber, although the normal variation of chamber depth could be done to polygenic factors. An usually high incidence of glaucoma among siblings of patient with primary angle closure glaucoma was recorded by weeker, Gouguard-Rion and Gouguard (1955). Grieten and Weekers (1962) showed that the mean measurements for eyes angle closure glaucoma gave anterior chamber depth 0.73 mm more shallow for eyes of the same age with same degree of hypermetropia. Tornquist (1956) concluded (i) The axial anterior chamber depth in acute glaucoma is less than that in normal eyes, and estimated at the onset of the disease to be on an average 1.78 mm. in males and 1.63 mm in females, that is about two thirds of normal depth, (ii) In binocular acute angle glaucoma when two eyes develop the disease simultaneously no significant difference between chamber depth is observed but when the two eyes develop disease successively, the anterior chamber depth of the first eye to be affected is less than that of the second eye, the difference being statistically significant (iii) In uniocular glaucoma the chamber depth of the healthy eye is less than that in a random sample of eyes, the difference being statistically probable. The difference between the chamber depths of the two eyes statistically significant, the glaucomatous eye showing the greatest reduction, the cause of this difference probably lying in an unequality between the two eyes which existed even before the onset of the disease.

Tornquist (1956) stated that it was not possible to determine crucial threshold value below which the risk of acute angle glaucoma appears,neverthless primary angle closure glaucoma is extremely uncommon in eyes with anterior chamber deeper than 2.4 mm, Its frequency increases as the anterior chamber depth progressively decreases to 1.8 to 1.7 mm. Sugar (1941) emphasized that in hypermetropia, the root of iris is inserted further forwards on the antero-medial surface of the ciliary body to account for shallowness of anterior chamber. Lowe (1970) concluded that shallow anterior chambers

of primary angle closure glaucoma are caused by incoordination of structures between the lens and the eyeball. The thick anteriorly cited lens can be expected to affect ciliary body causing its apparent rotation and correlated shallowing of anterior chamber angle. He studied a large group of eyes with angle closure glaucoma using ultrasound and obtained measurements confirming Torrquist's work. The chamber depth of glaucomatous eye was 1.8 mm (-+) 0.25 compared to 2.8 mm (-+) 0.36 for a group of age and sex matched normal eye. None of the eyes with angle closure had a chamber depth of greater than 2.4 mm. Philps (1972) pointed out that the size and shape of the anterior chamber results from the characteristics of structures bordering it. Zhao (1985, 1986) measured anterior chamber depth in primary angle closure glaucoma and its relation in early diagnosis Markowitz and Morin (1984) concluded that forward movement of the iens, probably secondary to loosening of zonulus is also a factor in the shallowing of anterior chamber. Makabe (1989) using echography (B-Scan) and gonioscopy found a weak correlation between the width of the angle and depth of anterior chamber. Lee, Brubaker and Ilstrup (1984) studied anterior chamber depth, volumes and diameters photogrammetrically and found them to be significantly smaller than age, sex and refractive error matched normal controls. Mapstone (1981) described closed angle glaucoma with non shallow anterior chamber.

Bakan (1954) stated that in many cases a measurable increases in the axial depth of the anterior chamber was found to occur following iridectomy. Tornquist (1959) and coakes et al (1979) stated that peripheral iridectomy deepens the peripheral anterior chamber of patients with narrow angles without altering the depth of the central anterior chamber.

Rosenger (1931) found that miotic drugs decreased anterior chamber depth in patients younger than 45 years, but did not effect anterior chamber depths in elderly patients. Nagataki and Brubaker (1982) found that 0.5% pilocarpine hydrochloride decreases anterior chamber volume. The hypothesized mechanism of anterior chamber

shallowing was that miotic drugs induce accomodative spasm causing the lens to thicken and move anteriorly, thus reducing the axial chamber depth.

[B] AXIAL LENGTH :

Bensen (1967) concluded that most of the hypermetropes have shorter axial length than average. His results were parallel to a study done by Nettleslip (1872). The hypermetropic eye was typically seal1 only in antero-posterior diameter but in all meridians. Lowe (1968) correlated anterior rhamber depth and axil length in normal eyes. The findings concurred with similar conclusion by Jansson (1963) and Stenstorm (1948). By contrast typically shallow anterior chamber of primary angle closure glaucoma can occur in eyes of any axial length. This observation was pertinent to a report that no total refractions state necessarily excludes the possibility of primary angle glaucoma (Lowe 1961).

In Lowe's study (1970), the corneal radius of curvature shows extreme correlation with axial length in both type of eyes. As the cornea is a part of the eyeball wall, a correlation might have been expected, and for primary angle glaucoma the degree of correlation confirms that the cornea is a coordinated structure for eyeball size. In normal eyes this thickness is universally and lens position is directly correlated with axial length.These correlations are the main determinants of anterior chamber depth compared with eyes of average length, short eyes will tend to have thinner lenses sited more posteriorly. By contrast, in primary angle closure glaucoma. There is no significant correlation between thickness and portion of the lens and axial length. Although cornea is a coordinated structure in relation to eyeball size, the lens is incoordinated, both its thickness and its position in relation to the eyeball walls. In primary angle closure glaucoma, loss of coordination between lens ano length shows an excessively thick and anteriorly sited lenses which in turn produce shallow anterior chamber.

[C] CORNEAL THICKNESS :

Lowe (1969) concluded that no statistical difference was present between the mean central corneal thickness of normal eyes and those with primary angle closure glaucoma. For normal eyes no correlations were found for central corneal thickness against axial length, mean radius of curvature or age. For eyes with primary angle closure glaucoma, no correlations were found for central corneal thickness against axial length or mean radius of corneal curvature, but a minute significant central corneal thining was found with increasing age Curvature and thickness of cornea have no special effect in producing the shallow anterior chamber typical of with primary angle closure Glaucoma.

Saxena Sandeep et al (1993) found a highly statistically significant association of CCT with the occurance of the disease. An increase in CCT is associated with the increase in probability of getting PACG.

Corneal thickness assumes importance only during severe attacks of acute angle closure glaucoma when the thickened oedematous cornea can encourage iridocorneal contact and Peripheral anterior synechiae.

[D] CORNEAL CURVATURE :

Lowe (1970) correlated corneal radius of curvature to other biometric Parameters. The corneal radius of curvature showed extreme correlation with axial length in both type of eyes. As the cornea is a part of the eyeball wall, a correlation might have been expected, and for primary angle closure glaucoma the degree of correlation confirms that the cornea is a coordination structure for eyeball size. Lowe (1969) could not find any correlation between lens thickness and corneal radius of curvature for eyes with primary angle closure glaucoma although a significant correlation was found for normal eyes.Grietenand Weekers (1962) showed

that mean measurements for eyes with angle closure glaucoma gave corneal curvatures 0.20 mm less than for eyes of the same age with the same degree of hypermetropia. Lowe (1969) found no correlation between mean radius of corneal curvature and central corneal thickness.Lowe (1969) concluded that curvature of the cornea has no special effect in producing the shallow anterior chamber typical of eyes with primary angle closure glaucoma.

Saxena Sandeep et al (1993) found a highly statistically significant association of CCT with the occurance of the disease. An increase in CCT is associated with the increase in probability of getting PACG.

OVERALL STUDY PLAN

OVERLL STUDY PLAN

(A) AIMS OF STUDY :

To study central corneal thickness and corneal curvature in cases of Primary angle Closure Glaucoma (PACG) and to corrlate them in the genesis of the disease.

(B) HYPOTHESIS :

1- The patients with a greater corneal thickness are at a significantly greater risk of having PACG as compared to those who have lesser corneal thickness.

2- The patients with a lesser corneal radius of curvature contribute to shallowing of anterior chamer and these patient have significantly greater risk of having PACG as compared to those who have greater corneal radius of curvature.

(C) STYDY DESIGN :

Hospital based case control study.

(D) SELECTION OF CASES AND CONTROL :

The cases will be that of PACG 40 years or more presenting with any stage of the disease. The controls will be the patients aged 40 years or more with refractive error.

(E) STUDY VARIABLES :

Age, sex, refractive error, central corneal thickness and corneal curvature.

(F) OUT-COME VARIABLE :

Primary angle closure glaucoma.

(G) CONFOUNDERS :

- Age
- Sex
- Refractive error :

NOTE :- Other cases of angle closure glaucoma (Secondary angle closure glaucoma) will be ruled out at the time of case selection.

(H) METHOD OF ANALYSIS :

Univariate analysis, two sample "T test" and Logistic regression to analysis the association between the study variables and the outcome variable.

(I) ETHICAL ASPECT :

Since this is an observational study, therefore ethically it is justified.

MATERIAL AND METHODS

MATERIAL AND METHODS

SELECTION OF SUBJECTS :

The study design was that of a case control study. The cases were that of primary angle closure glaucona (PACG). The study was carried out on 60 consecutive eyes (30 patients) presenting with any stage of primary angle closure glaucoma (PACG) to the OPD of Deprtment of Ophthalmology, Maharani Laxmi Bai Medical college, Jhansi in collaboration with late Shri Mool Chand Gupta Memorial Hospital, Jhansi. The disease difinition was kept as under :

"Patients presenting with history of pain with or without redness associated with diminution of vision and coloured halos, having a raised intra ocular pressure (IOP) and narrow anterior chamber angle without evidence of any secondary cause of raised intra ocular pressure".

The controls were the patients aged 40 years or more presenting to the OPD with refractive error on the day when a case was admitted to the study, who was the first to agree to undergo all the investigations planned in this study.

All the cases and controls who could be successfully investigated were the study subjects included in the analysis. In all these were 120 eyes (60 study subjects) (100% of the sampling frame).

DURATION OF STUDY :

The perioa of this study was from March,1995 to November,1995.

MEASUREMENTS OF VARIABLES :

(a) Primary Angle Closure Glaucoma

This was measured as per disease definition. The intraocular Pressure was recorded by a Schiotz indentation tonometer. The anterior segment was examined by a Haag Streit 900 slit lamp biomicroscope. Gonioscopy was dome by Goldmann 3 mirror contact lens. Gonioscopic evaluation of the anterior chamber angle width was done by Shaffer's grading system based on the extent of visible angle structure.

Anglar width	Angle structure visualised	Clinical interpretation
Grade 4 - Wide open (35^0 - 45^0)	Ciliary body	Closure impossible
Grade 3 - Moderately narrow (20^0 - 35^0)	Scleral spur	Closure possible
Grade 2 - Extremely narrow (20^0)	Trabeculum	Closure probable
Grade 1 - Partly/Totally closed (10^0)	Schwalbe's line	Closure imminent
Grade 0 (0)	Irido corneal contact	Closure present

It was treated as dichotomous variable

0 - No disease

1 - Disease

(b) **Age** : Treated as continuous variable.

(c) **Sex** : 1 - Male

2 - Female

(d) **Refractive error** :

Refractive error of the patient was estimated by traditional spot retinoscopy and/or auto refractometer (Nidek 800), and spherical equivalent was calculated.

(e) **Central corneal thickness** :

Central corneal thickness was measured by Echopac (Alphacom 42) pachymeter. It was treated as continuous variable Specification of pachymeter.

- Model - Echopac (Alphacon 42)'
- Propagation speed : Cornea - 1550 mt/Sec.
- Refractive index : Cornea - 1.3 375

As and where possiole the pachymetry was also done in the cases after their medical control of IOP and after surgical management.

(f) **Curvature of the cornea** :

Curvature of the cornea was measured by Keratometer KMS-6 Bausch & Lamb Model (Appasamy Associates). It was treated as continuous variable.

DATA MANAGEMENT

All the data was recorded on a prefixed proforma and reviewed.

ANALYS IS :

(1) A univariate analysis was done on Minitab software.

(2) A two sample T test was done to compare the means of various variables in "Subjects who had glaucoma" and "Subjects who did not have glaucoma".

(3) A logistic regression was done to analyse the association between the dependent variable (PACG) and independent variables (Age, sex, refractive error, central corneal thickness (CCT), corneal curvature (CC)) with the following model :-

$$\text{Log } (P/1-P) = X + B_1 \text{ age} + B_2 \text{ sex} + B_3 \text{ refractive error} + B_4 \text{ CCT} + B_5 \text{ CC.}$$

Where ,

P = Probability of having PACG

X = Constant

B = Coefficient of the independent variables.

The varibles which showed statistically significant association were included in the final model.

OBSERVATIONS AND DISCUSSION

OBSERVATION AND DISCUSSION

One hundred and twenty eyes were included in this study. The data was stored on prefixed proforma and analysed on a computer using a biostatistical software package.

Statistical analysis of the variables was done. Mean, Standard deviation (STDEV), Standard error of mean (SEMEAN) Mininum and maximum and range were calculated. The following tables display these values of variables in PACG and in controls :

(1) Age

TABLE - 1

	Eyes	Mean	St Dev	Range
PACG	60	49.8	7.3	40 to 64
Controls	60	44.9	3.8	40 to52

(2) Sex

TABLES - 2

	Cases	Male	Female
PACG	30	11	19
Controls	30	14	16

(3) Refractive error

TABLE - 3

	Eyes	Mean	St Dev	Range (Dioptres)
PACG	60	1.43	1.49	-1.50 to +7.0
Controls	60	0.70	0.92	-1.25 to +2.5

(4) Central corneal thickness :

TABLE - 4

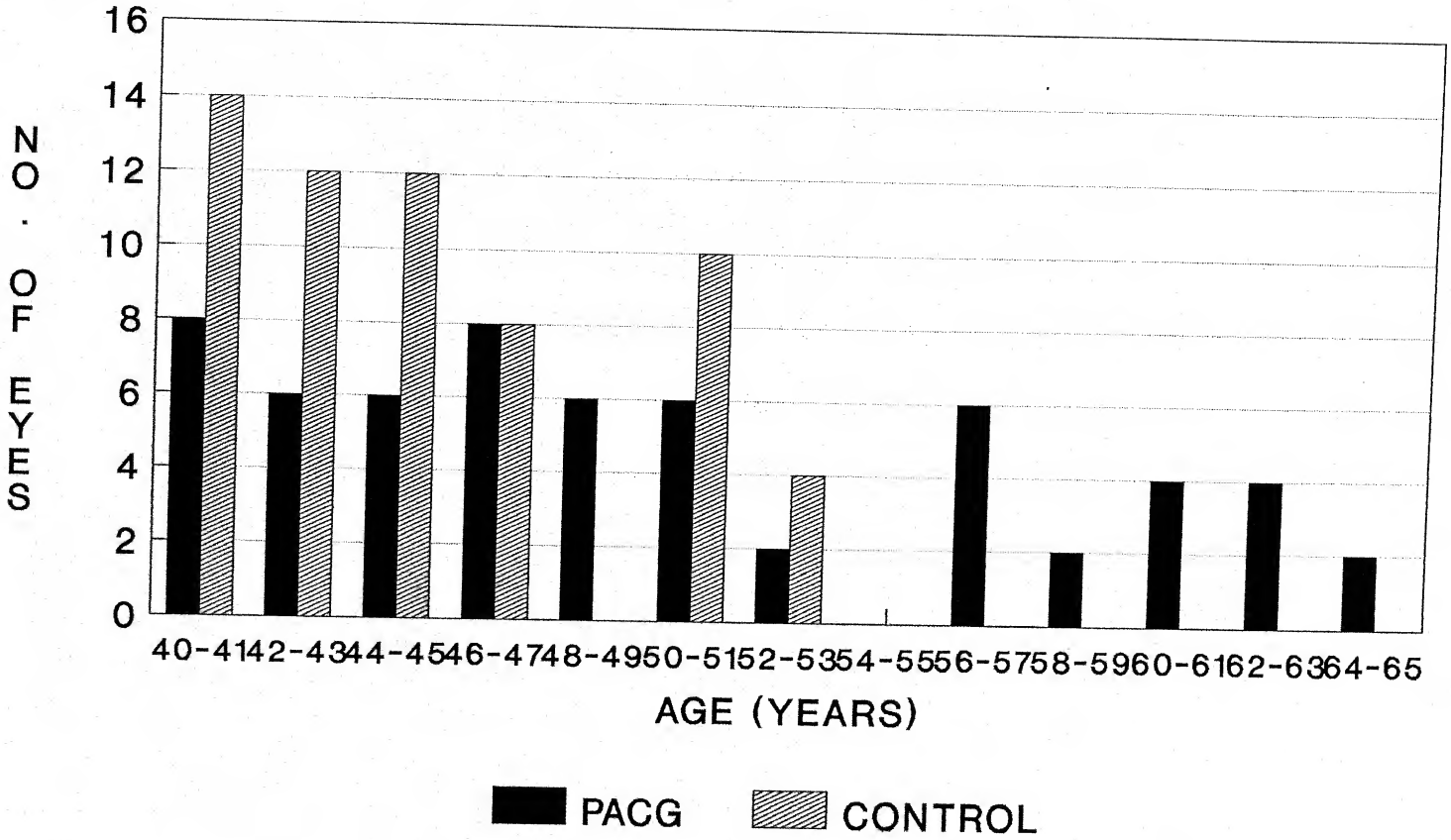
	Eyes	Mean	St Dev	Range (microns)
PACG	60	581	29	513 to 644
Controls	60	568	17	521 to 593

(5) Corneal curvature :

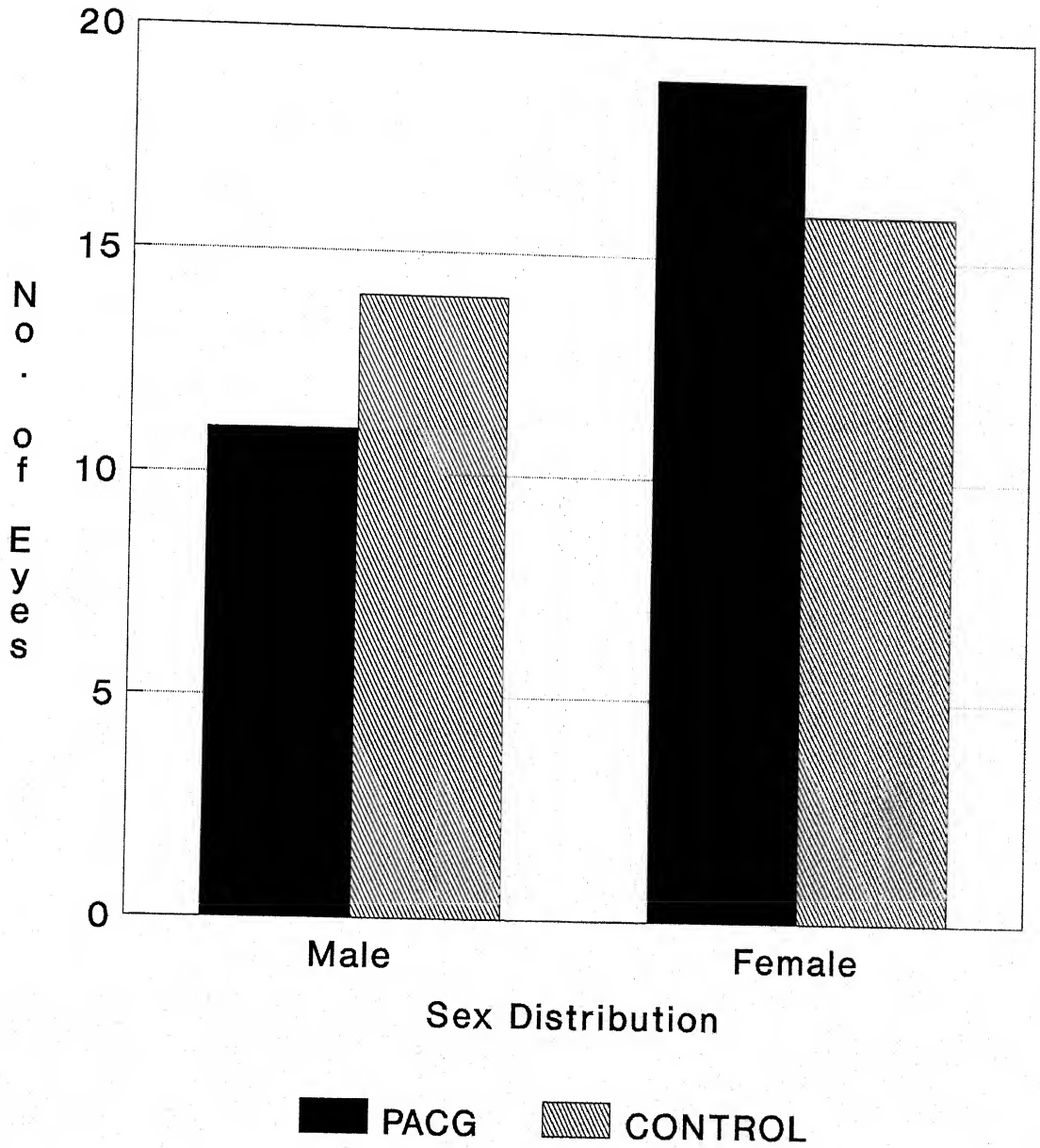
TABLE - 5

	Eyes	Mean	St Dev	Range (mm)
PACG	60	7.25	0.21	6.70 to 7.80
Controls	60	7.55	0.11	7.15 to 7.70

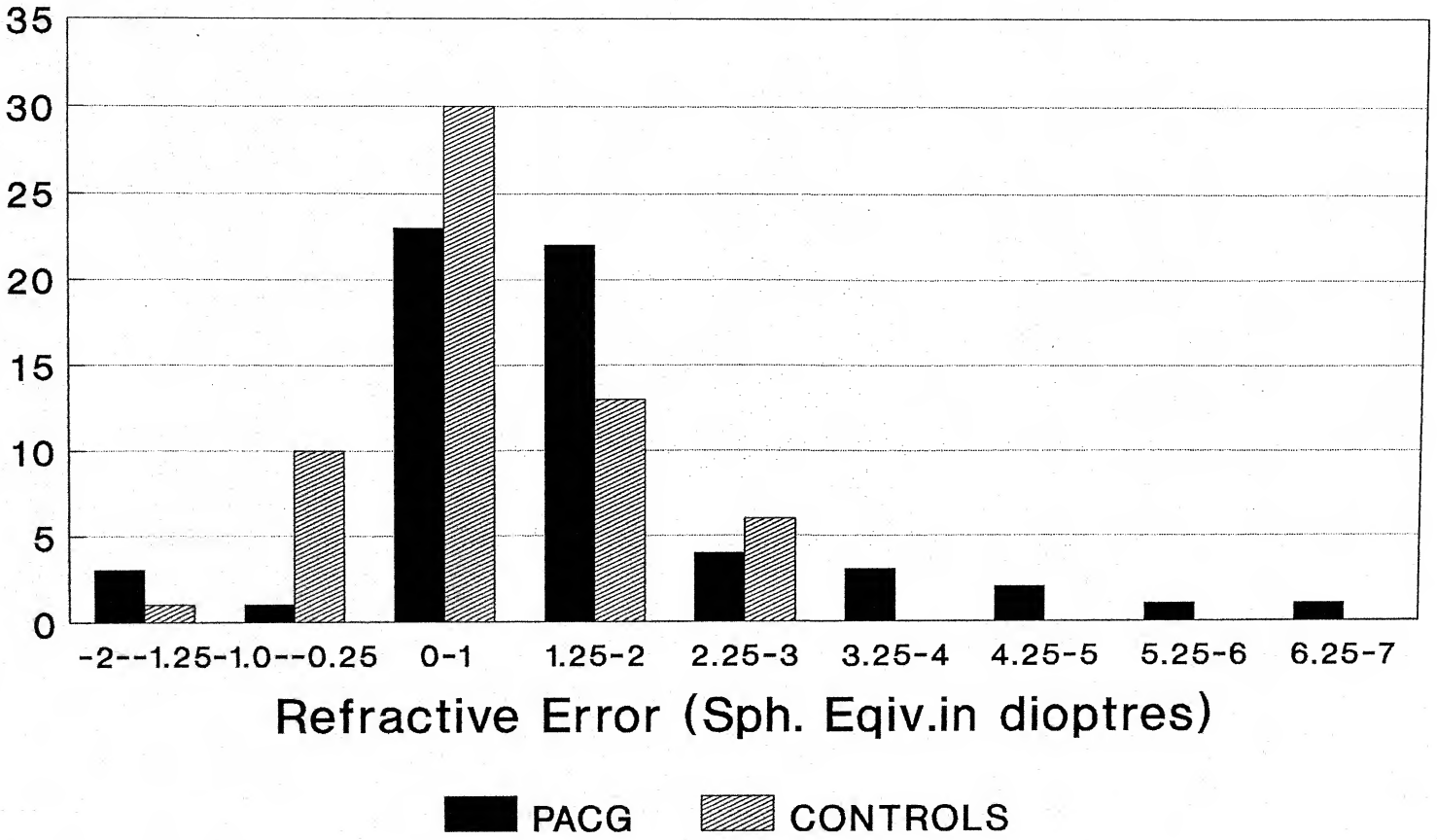
AGE DISTRIBUTION IN PRIMARY ANGLE CLOSURE GLAUCOMA AND CONTROL



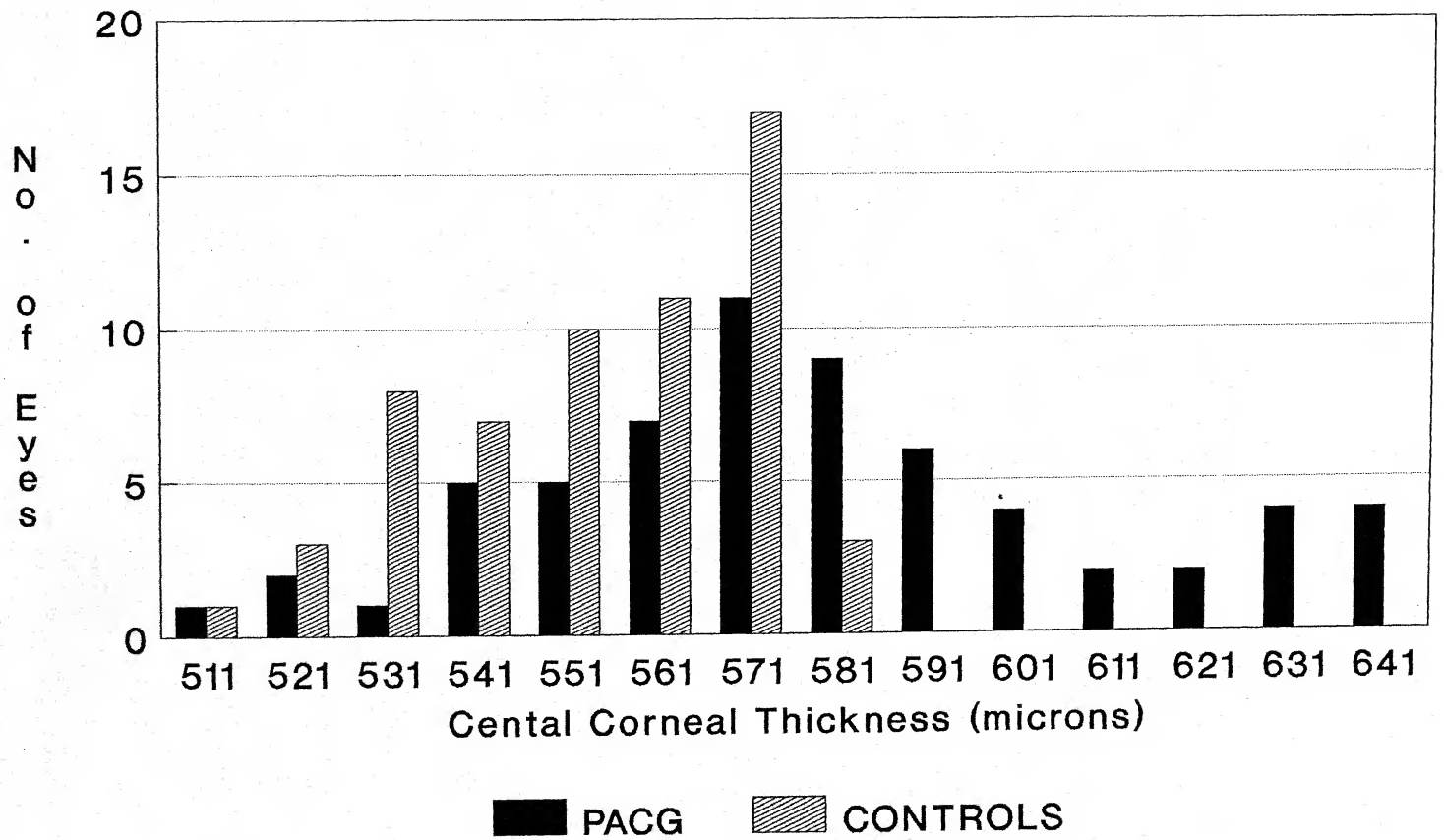
SEX DISTRIBUTION IN PRIMARY A CLOSURE GLAUCOMA AND CONT



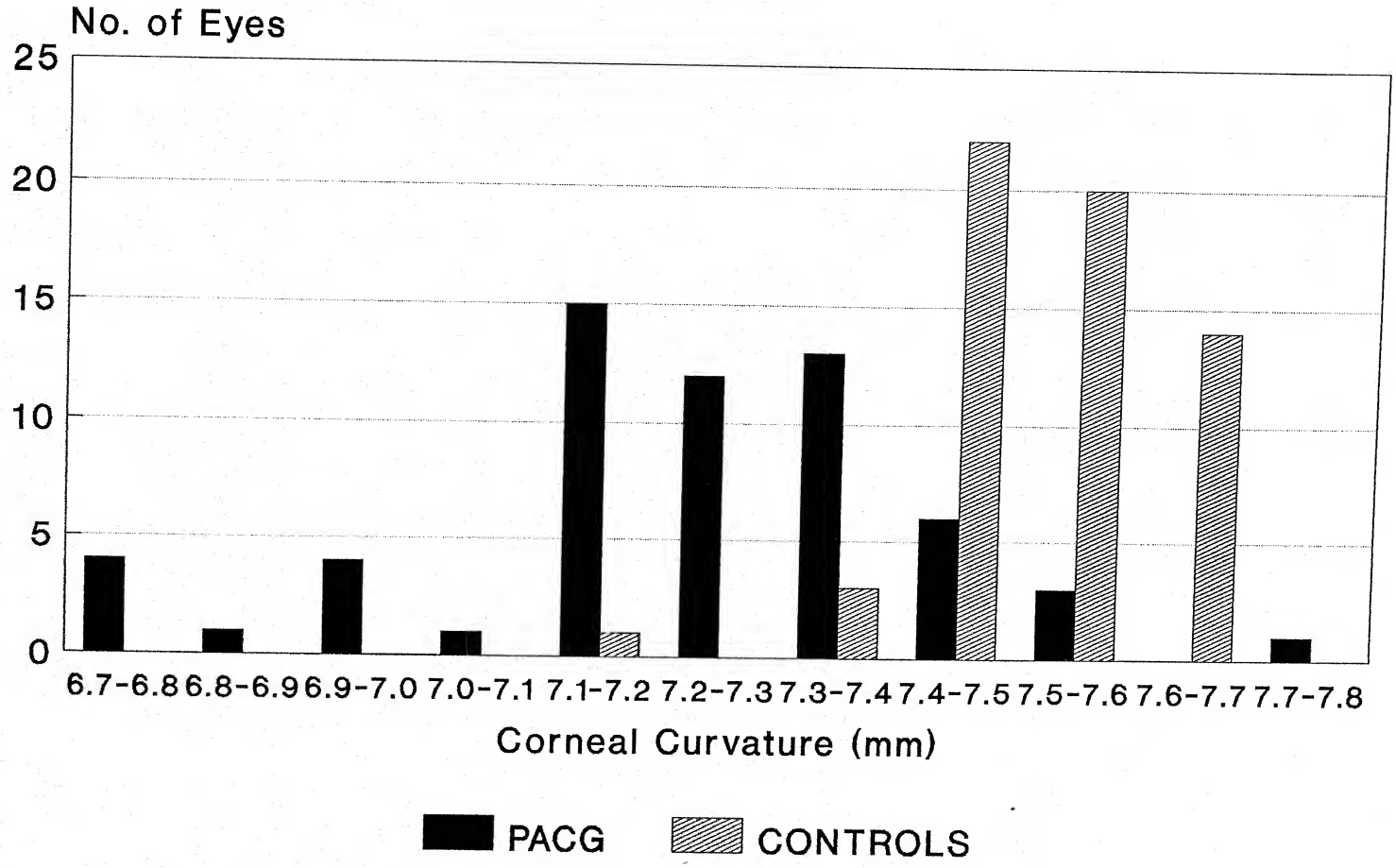
REFRACTIVE ERROR IN PRIMARY ANGLE CLOSURE GLAUCOMA AND CONTROL



CENTRAL CORNEAL THICKNESS IN PRIMARY ANGLE CLOSURE GLAUCOMA AND CONTROL



CORNEAL RADIUS OF CURVATURE IN PRIMARY ANGLE CLOSURE GLAUCOMA AND CONTROLS



Distribution of the viriables in PACG and controls displayed in the histograms . Unirate analysis, two sample 'T test' was done to analyse the association of various parameters with PACG.

(1) UNIVARIATE ANALYSIS :

(a) Age : Univariate analysis of age in patients with PACG and controls showed a wider age distribution in PACG as compared to controls alongwith overlapping.

(b) Refractive Error : Univariate analysis of refractive error in PACG and control showed a wider range of refractive error in PACG alongwith overlayping. They were more hypermetropic than the controls.

(c) Central corneal thickness : Univariate analysis of CCT in PACG and controls showed a wider range of CCT in PACG with overlapping. CCT was greater in PACG.

(d) Corneal Curvature : Univariate analysis of CC in PACG and controls showed a wider range of CC in PACG with overlapping. CC was lesser in PACG than controls.

(2) TWO SAMPLE T TEST :

Two sample 'T Test' of each variable comparing PACG with Controls was done. Mean, standard deviation (STDEV) and standard error of the mean (SEMEAN) was calculated alongwith 95% confidence interval of the difference between two mean and T-Score as well as P-value of the significance test was computed.

For analysis-

1 = PACG

0 = CONTROL

(a) **Age** : Two Sample T-test for Age_1 vs age_0.

	N	Mean	ST DEV	SEMEAN
Age_1	60	49.8	7.3	0.94
Age_0	60	44.9	3.8	0.49

T = 4.612 P= 0.0000

Since the T score falls in the rejection zone, we reject the null hypothesis of no difference and conclude that true difference exists between the mean age of subjects with PACG and controls. P - value is <0.05,therefore difference is statistically significant.

(b) **Refractive Error** : Two sample T-Test for Ref_1 vs Ref_0

	N	Mean	ST DEV	SEMEAN
Ref_1	60	1.43	1.49	0.19
Ref_0	60	0.70	0.92	0.12

T = 17.6863 P= 0.0000

Since the T score falls in the rejection zone, we reject the null hyoothesis of no difference and conclude that a true difference exists between the mean refractive error of subjects with PACG and controls. P value in <0.05, therefore, this difference is statistically significant.

(c) Central Corneal Thickness : Two sample T-Test for CCT_1 vs CCT_0

	N	Mean	ST DEV	SEMEAN
CCT_1	60	581	29	3.74
CCT_0	60	568	17	2.19

T = 2.9956 P= 0.0025

Since the T score falls in the rejections we reject the null hypothesis of no difference and conclude that a true difference exists between the mean CCT of subject with PACG and controls. P-value <0.05, therefore, this difference is statistically significant.

(d) <u>Corneal curvature</u> : Two sample T- Test for CC_1 vs CC_0

	N	Mean	ST DEV	SEMEAN
CC_1	60	7.25	0.21	0.027
CC_0	60	7.55	0.11	0.014

T = 9.8023 P= 0.0000

Since the T score falls in the rejection zone we reject the null hypothesis of no difference and conclude that a true difference exists between the mean CC of subject with PACG and control. P value is <0.05, therefore, this difference is statistically significant.

TABLE A

Comparison of mean spectacle refraction of eyes with PACG.

STUDY	EYES	DIOP	0 TO 1	1.25 TO 2.00	2.25 TO 3.00	3.25 TO 4.00	4.25 TO 5.00	5.25 TO 6.00	6.25 TO 7.00	7.25 TO 8.00	8.25 TO 9.00	OVER 9.00
LOWE (1970)	127	+	42	31	19	14	6	6	-	-	2	-
		-	4	1	-	-	-	-	1	1	-	-
SAXENA etal (1993)	70	+	18	28	3	3	3	8	1	-	1	1
		-	-	4	-	-	-	-	-	-	-	-
PRESENT STUDY (1995)	60	+	23	22	4	3	2	1	1	-	-	-
		-	1	3	-	-	-	-	-	-	-	-

TABLE B

Summary of comparison of CCT and CC measurement between normal eyes and eyes with PACG (Means with standard Deviations)

SERIES OF EYES	Parameter		CCT	C.C
LOWE (1970)	157 NORMAL	MEANS	517 s.d. 34	7.67s.d.0.24
		RANGE	410 - 600	7.13 - 8.54
	118	MEANS	533 s.d. 34	7.61s.d.0.29
	PACG	RANGE	440 - 630	6.96-.8.31
T test between means			N.S.	S
SAXENA (1993)	70 NORMAL	MEANS	569 s.d. 10	7.53s.d.0.11
		RANGE	546 - 577	7.15 - 7.70
	70	MEANS	580 s.d. 20	7.23s.d.0.25
	PACG	RANGE	544 - 631	6.70-8.00
T test between means			H.S.	H.S.
PRESENT STUDY (1995)	60 NORMAL	MEANS	568 s.d. 17	7.55s.d.0.11
		RANGE	521 - 593	7.15 - 7.70
	60	MEANS	581 s.d. 29	7.25s.d.0.21
	PACG	RANGE	513 - 644	6.70-7.80
T test between means			H.S.	H.S.

N.S - Not Significant H.S. - Highly Significant S - Significant

The results of present study (1995) were compared with that of Lowe (1970) and Saxena el at (1993) depicted in the tables.

Table A shows the spherical equivalent of the spectacle refraction of 60 eyes in present study as compared with the spherical equivalent of the spectacle correction of 127 eyes in the study of Lowe (1970) and 70 eyes in the study, of Saxena et al (1993). Most of the eyes found to be hypermetropic . Myopic eyes were very few but some were present. Results of present study were similar to those of Lows (1970) and Saxena et al (1993).

Table B shows the means and range of central corneal thickness and corneal curvature in the present study as compared with those of Lows (1970) and Saxons et al (1993). The means of CCT and CC showed significant difference between the eyes with PACG and controls in all three studies. The mean CCT was greater in eyes with PACG in present study. The mean CC was lesser in eyes with PACG in the present study.

In Lowe's Study (1970) CC had a significant association where as CCT did not have a statlstically significant association with PACG. In Saxena et al study (1993) both CC and CCT had highly significant association with PACG. However, in pressent study (1995) both variables had a highly significant association with PACG.

Although the means were significantly different, the ranges showed that there is overlapping for some measurements from individual eyes in the two groups in all three studies.

Central Corneal Thickness in Acute conjestive glaucoma

Central corneal thickness showed alteration during an attack of acute congestive glaucoma CCT was found increase during an attack of acute congestive glaucoma. The maximum CCT recorded during and attack was 644 microns (10.86% more than mean CCT of 581 microns) . Increased corneal thickness may predispose to peropheral anterior synechiae formation

CONCLUSION

CONCLUSION

In the present study, 60 eyes of 30 patients of PACG have been studied. Results were compared with an equal number of control group. The following are the conclusions that were drawn.

(1) Age : had a statistically significant association with PACG. An increase in age by one year increased odds of developing PACG.

(2) Sex : did not have a statistically significant association with PACG.

(3) Refractive Error : had a statistically significant association with PACG. Eyes with PACG had a tendency to be hypermetropic, however, PACG may also occur in eyes with myopia.

(4) Central Corneal Thickness : had a statistically significant association with PACG. It increased during acute congestive attacks .

(5) Corneal Curvature : had statistically significant association with PACG.
lesser the curvature there is increase chances of PACG.

Greater corneal thickness and lesser corneal radius of curvature contribute to shallowing of anterior chamber.

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MASTER CHART

MASTER CHART
PACG

NO.	NAME	AGE	SEX	EYE	REF.ERROR	GONIO GR.	C.C.T.	C.C.(AV.)
1.	KUSUM GUPTA	47	F	R L	+1.25 +1.0	2 2	576 542	7.35 7.20
2.	BABITA	42	F	R L	+1.25 +1.25	2 2	528 526	7.50 7.50
3.	KAUSHALYA	46	F	R L	+1.50 +2.25	2 1	566 579	7.25 7.40
4.	DEV PRASAD	51	M	R L	+0.25 +0.50	1 2	590 513	7.35 7.55
5.	SARITA	48	F	R L	+1.0 +1.0	1 1	585 569	7.25 7.30
6.	KAILASH	62	M	R L	+2.5 +1.0	1 2	608 548	7.30 7.35
7.	BHAWATI DEVI	58	F	R L	+1.0 +0.5	2 1	595 613	7.35 7.20
8.	NARAYAN DAS	62	M	R L	+1.75 +2.0	1 0	633 644	7.20 7.20
9.	R.C. KUSHWAHA	45	M	R L	+0.5 +1.0	2 1	579 603	7.00 7.05
10.	GIRIRJA DEVI	53	F	R L	+7.0 +6.0	1 1	581 598	7.40 7.25

MASTER CHART
PACG

NO.	NAME	AGE	SEX	EYE	REF.ERROR	GONIO GR.	C.C.T.	C.C.(AV.)
11.	NEELU SINGH	40	F	R L	-1.50 -1.25	2 1	552 582	7.80 7.35
12.	JAHAN ARA	60	F	R L	+0.50 +0.50	1 1	577 559	7.55 7.55
13.	SAVITRI	56	F	R L	+1.0 +1.0	1 1	585 569	7.20 7.20
14.	HARI PAL	47	M	R L	+0.75 +1.0	1 1	550 569	7.50 7.45
15.	G.K. NIGAM	57	M	R L	-1.00 -1.25	1 1	600 596	7.50 7.40
16.	RATAN PAL	41	M	R L	+1.75 +2.0	0 1	631 577	7.15 7.15
17.	PAN KUNWAR	40	F	R L	+0.75 +0.75	1 1	589 584	7.40 7.35
18.	DEVI PRASAD	56	M	R L	+1.50 +1.75	1 0	597 629	6.75 6.70
19.	HARDAYAL	45	M	R L	+2.50 +1.75	0 0	628 631	7.35 7.30
20.	GOMTI DEVI	51	F	R L	+1.0 +1.0	2 1	569 585	7.20 7.20

MASTER CHART
PACG

NO.	NAME	AGE	SEX	EYE	REF.ERROR	GONIO GR.	C.C.T.	C.C.(AV.)
21.	ISHRAT JAHAN	48	F	R L	+4.75 +3.50	1 2	631 577	6.75 6.80
22.	R.K. SINGH	42	M	R L	+1.50 +1.75	1 1	584 576	7.15 7.25
23.	ZUBIDA	50	F	R L	+0.25 +0.25	1 2	620 603	7.30 7.25
26.	ZAHIDA HUSEIN	46	F	R L	+3.75 +4.50	1 2	603 587	6.90 7.00
27.	BRIJ KUMARI	49	F	R L	+3.00 +1.25	1 1	592 578	7.15 7.15
28.	H.P. SINGH	40	M	R L	+0.50 +0.50	1 1	550 569	7.45 7.35
29.	DAULTESH	45	F	R L	+1.50 +0.50	1 2	556 532	7.15 7.15
30.	UMA SAXENA	61	F	R L	+1.25 +2.50	1 1	546 558	7.00 7.00

CONTROL

NO.	NAME	AGE	SEX	EYE	REF. ERROR	GONIO GR.	C.C.T.	C.C.(AV.)
1.	DR. HABIB	46	M	R L	+2.50 +2.25	3 3	550 546	7.50 7.50
2.	RAJNI	41	F	R L	+0.50 +0.50	3 3	558 577	7.50 7.45
3.	MAMTA RAJPUT	50	F	R L	-0.75 -0.75	3 3	564 579	7.50 7.50
4.	R.M. PATHAK	41	M	R L	+0.25 +0.25	3 3	569 585	7.70 7.70
5.	DR. R.K. TIWARI	40	M	R L	+0.25 +0.25	3 3	572 551	7.70 7.70
6.	MANISH	42	M	R L	+0.25 +0.25	3 3	576 584	7.60 7.60
7.	SNEHLATA	42	F	R L	+1.50 +1.50	3 3	587 592	7.50 7.50
8.	JAGDISH RAI	52	M	R L	+1.00 +1.00	3 3	578 585	7.15 7.35
9.	MADHUMATI RAI	50	F	R L	+0.75 -0.25	3 3	576 542	7.35 7.35
10.	BABITA	44	F	R L	+0.50 +1.00	3 3	569 585	7.65 7.65

CONTROL

NO.	NAME	AGE	SEX	EYE	REF.ERROR	GONIO GR.	C.C.T.	C.C.(AV.)
11.	KAUSHALYA	46	F	R L	+2.00 +1.75	3 3	579 552	7.50 7.50
12.	G.K NIGAM	42	M	R L	+0.50 +0.25	3 3	562 585	7.65 7.65
13.	RAJEEV GOYAL	45	M	R L	+0.25 +0.25	3 3	569 590	7.65 7.50
14.	VIVEK SHARMA	41	M	R L	+0.25 +0.25	3 3	586 546	7.70 7.60
15.	KAVITA	42	F	R L	+1.00 +1.00	3 3	550 553	7.45 7.50
16.	KUSUM GUPTA	45	F	R L	+1.00 +1.00	3 3	569 585	7.50 7.55
17.	SARITA	42	F	R L	+0.50 +0.75	3 3	572 551	7.60 7.60
18.	KAILASH	46	M	R L	+2.00 +2.25	3 3	576 584	7.60 7.55
19.	NARAYAN DAS	40	M	R L	-1.00 -0.75	3 3	537 557	7.65 7.60
20.	NEELAM RAI	51	F	R L	+2.25 +2.00	3 3	587 579	7.70 7.55

CONTROL

NO.	NAME	AGE	SEX	EYE	REF.ERROR	GONIO GR.	C.C.T.	C.C.(AV.)
21.	SAVITRI	45	F	R L	-0.75 -0.75	3 3	521 532	7.60 7.60
22.	HARIPAL	47	M	R L	+1.50 +1.75	3 3	592 584	7.50 7.50
23.	KISHORE	43	M	R L	+1.00 +1.00	3 3	578 564	7.55 7.50
24.	HARI PRASAD	52	M	R L	-0.75 -0.75	3 3	559 564	7.50 7.50
25.	BRIJ KUMARI	41	F	R L	+2.25 +1.75	3 3	587 593	7.60 7.65
26.	KOMAL RASTOGI	40	F	R L	+0.50 +0.50	3 3	571 542	7.50 7.50
27.	SHAHNAZ	45	F	R L	+1.25 +0.75	3 3	585 550	7.50 7.60
28.	K.B. YADAV	42	M	R L	-1.25 -0.50	3 3	539 564	7.60 7.60
29.	Z. NISHA	51	F	R L	+1.00 +0.75	3 3	549 583	7.55 7.50
30.	JAMWATI	50	F	R L	+1.25 +1.25	3 3	588 582	7.65 7.60

WORKING PROFORMA

Clinical profile of Primary Angle Closure Glaucoma Patients

MRD No. _____ Case No._____
Date _____

Name _____ Age/Sex- M/F
Address _____ Cast -H/M/S/C/Other
_____ Economical Status -
_____ Litracy -

HISTORY OF GLAUCOMA	RE	LE
- Pain - Diminution of Vn - Redness - Photophobia - Colour Halos - Associated Symptoms		
EXAMINATION OF THE EYE	**RE**	**LE**
- Lid proper & lid margin - Eye Ball - Conjectiva - Cornea - A/C - Iris - Pupil - Lens - Vission - Tension - Fundus - Referactive Error - Central Corneal Thickness - Corneal Carvature - Gonioscopy		

SUMMARY

SUMMARY

Primary angle Closure Glaucoma (PACG) is an important blinding disease causing temporary and permanent visual loss all over the world. It occur in eyes with a recognigable predisposition. Shallowness of the anterior chamber is an important factor .

The size and shape of the anterior chamber results directly from the structure bordering it. Two aspects of the cornea may affect anterior chamber depth. The corneal thickness and the radius of curvature. The eyes with primary angle closure glaucoma have a thicker cornea and lesser radius of curvature.

To study and to correlate these corneal parameters in the genesis of the disease this study was undertaken.

Lowe RF (1970) was the first person to correlate them with the genesis of PACG. After a long pause, Saxena et al (1993) again correlate them with the genesis of the disease, and showed a highly significant associstion.

The present study was carried out in the Department of Ophthalmology, M.L.B. Medical College, Jhansi in Colloboration with Late Shrl Mool Chand Gupta Memorial Hospital, Jhansi over a period from March 1995 to Nov.,1995.

The study design was that of a case control study. The study was carried out on 60 consecutive eyes (30 patients) presenting with any stage of primary angle closure glaucoma (PACG). The disease definition was kept as under.

"Patients presenting with history of pain with or wlthout redness associated with diminution of vision and coloured halos having a raised intra ocular pressure (IOP) and narrow anterior chamber angle without evidence of any secondary cause of raised intra ocular pressure".

The control were the patient aged 40 years or more presenting to the OPD with refractive error on the day when case was admitted to the study. In all thers were 120 eyes (60 study subjects) (100% of the sampling frame).

The intraocular pressure was recorded by schiotz indentation tonometer. Gonioscopy was done by Goldmann 3 mirror contact lens. Gonioscopic evaluation of the anterior chamber angle width was done by Shaffer's grading system based on the extent of visible angle structure. Refractive error was estimated by traditional spot retinoscopy and/or auto refractometer. Central corneal thickness was measured by Echopac pachymeter. The radius of curvature was measured by Keratometer.

All the data was recorded on prefixed proforma and analysed on a computer using a biostatistical software package. Mean, standard Deviation (St.Dev.) Minimum Maximum Range and Standard Error of Mean. (S.E. Mean) was calculated alongwith T-score as well P-value of significance test was computed.

The analysis showdd the following points -

Age :

Showed a wider range of distribution in PACG as compared to controls alongwith overlapping. The mean was 49.8 with S.D. of 7.3 ranging from 40 to 64 years in PACG. P-value showed a highly significance association.

Refractive Error :

Showed a wider range of distribution in PACG as compared to controls alongwith overlappin. The mean refractive error was + 1.43 D with S.D. of 1.49 ranging from 1.50 D to + 7.0 D in PACG as compared to +7.0 D with S.D. of 0.90 D ranging from - 1.25 D to + 2.5 D in control. P-value showed a highly significant association with the genesis of the disease.

Central corneal thickness :

Showed a wider range of distribution in PACG as compared to Controls alongwith overlapping. The mean CCT was 581 micron with S.D. of 29 micron ranging from 513 micron to 644 micron in PACG as compared to 568 micron with S.D. of 17 micron ranging from 521 micron to 593 micron in control . P value showed a highly significant association with the genesis of the disease.

Corneal curvature :

Showed a wider range of distribution in PACG as compared to controls alongwith overlapping. The mean CC was 7.25 mm with S.D. of. 0.21 mm ranging from 6.70 mm to 7.80 mm in PACG as compared to 7.55 mm with S.D. of 0.11mm ranging from 7.15 mm to 7.70 mm in Control. P-value showed a highly significant association with the genesis of disease.

Greater corneal thickness and lesser corneal radius of curvature contribute to shallowing of anterior chamber.